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J. Anderson.

SPECIAL REPORT

ON

PUBLIC WELLS IN GLASGOW,

BY

DR. ANDERSON;

WITH

MEMORANDUM BY THE MEDICAL OFFICER OF
HEALTH.

OCTOBER, 1865.

GLASGOW:

PRINTED BY R. ANDERSON, 85 QUEEN STREET.

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REPORT

ON THE

QUALITY OF THE WATER OF WELLS IN THE
GREEN AND OTHER PARTS OF GLASGOW.

IN examining into the composition of these waters, it seemed unnecessary to make minute analyses giving the proportion of all the different salts contained in them. I have, therefore, restricted my examination to the determination of the total solids, the fixed and volatile matters, the quantity of oxygen required for the oxidation of the organic matters, and an approximative estimate of the nitric acid, these being the data required for ascertaining the sanitary quality of water.

The total solids were determined by drying, at 240° Fahr., the volatile matters by the ignition of the residue, the oxygen required for oxidising the organic matters by a standard solution of Permanganate of Potash, and the nitric acid by Sulphate of Indigo.

The results obtained were as follows, the numbers giving the amount in grains per imperial gallon. A similar analysis of the Loch-Katrine water is appended for comparison:—

	1.	2.	3.	4.	5.
	Total Solids.	Fixed Salts.	Volat- tile Matters.	Oxygen required for ox- idation of Organic Matters.	Nitric Acid.
1. Arn's Well,	29.75	21.75	8.01	0.035	Considerable.
2. From large Spout, 1st East of the Humane Society,	20.96	15.48	4.48	0.035	Small.
3. Small Spout, 2d East of Humane Society,	20.32	16.96	3.36	0.070	Small.
4. Large Spout, at bend of River, opposite the West end of Gymna- sium,	25.12	20.32	4.80	0.035	Small.
5. Large Spout, opposite East end of Gymna- sium,	18.88	15.36	3.52	0.035	Small.
6. Clelland's Well, near Springboards, ...	15.36	12.32	3.04	0.033	Moderate.
7. Robin's Well, near Newhall Terrace, ...	13.84	8.72	5.12	0.035	Small.
8. M'Gavin's Well, near Charlotte Street, ...	19.36	14.64	4.72	0.030	Small.
9. Pump Well in John Street, Bridgeton, ...	77.52	61.52	16.00	0.070	Extremely large.
10. Pump Well in Old Coach Office Court,	34.80	27.20	7.60	0.070	Extremely large.
11. Spring Well, near Kel- vingrove House, off Sandyford Street, ...	11.36	9.04	2.32	0.052	None.
12. Spring Well in Kelvin- grove Park,	24.64	18.88	5.76	0.050	Rather large.
13. Loch-Katrine,	2.20	1.24	0.96	0.070	None.

It is obvious from inspection of this Table that all these waters are inferior to that of Loch-Katrine. No. 11 is the best, and may be described as quite unexceptionable, and indeed better than many waters used for the supply of towns.

All the other waters contained nitric acid, and though in some its proportion is small, and not sufficiently large to be of much importance, it is in all cases distinct. In Nos. 9 and 10 it is extremely large, and in the former about 23 times as much exists as in those where it is described as *small*.

In all cases the quantity of volatile matters is large, and this is due partly to the expulsion of nitric acid by heat, but very largely

also to the fact that most of these waters contain much sulphate of lime, which retains water at the temperature used for drying. No. 9, for example, contains 32·2 grains of that salt per gallon. The quantity of organic matter as indicated by the oxygen required to oxidise it is in all cases small; and this is no doubt due to the fact that the samples were taken at a very dry season, and under circumstances when any animal or vegetable matters which might find their way into the waters must have been very thoroughly oxidised and converted into a comparatively innocuous form. In winter, however, the state of matters may be very different, and there are probably times when all these waters (except of course No. 11) are more or less charged with decomposing matter, that is to say, animal and vegetable matter which has not yet passed into the form of nitric acid.

The general conclusions at which I arrive are:—

- 1st. That No. 11 may be used with perfect safety.
- 2nd. That Nos. 1, 6, 9, 10, and 12 should either be closed entirely, or rendered inaccessible for drinking purposes.
- 3rd. As regards the other waters it would be advisable to do so also if they form the constant domestic supply of any part of the population. If they are only occasionally resorted to this would not be essential, but if it be possible, at no great expense, to supply Loch-Katrine water in their place, it would no doubt be preferable to do so.

THOMAS ANDERSON.

3rd October, 1865.

MEMORANDUM BY DR. GAIRDNER IN REFERENCE
TO DR. ANDERSON'S REPORT.

GLASGOW, *October 16, 1865.*

IN submitting Dr. ANDERSON's Report on the Wells in the Green and elsewhere to the authorities, a few words will serve to indicate the medical principles on which the inquiry has proceeded, and the measures which, after due consideration, I think it my duty to propose for immediate adoption.

The impurities of the various samples of water analysed, including all the solids left as a residue by simple evaporation, are shown in the column marked (1) in the Report. But these impurities are not all equally dangerous to health; nay, some of them may even be considered to improve the quality of the water for drinking purposes, by giving to it a certain amount of palatable hardness. Of this kind are many of the fixed salts (2), which, in moderate quantities, are usually regarded as rather a desirable addition than otherwise to a drinking water. The volatile matters (3), on the other hand, viz., those converted into vapour at a red heat, include a large proportion of organic impurities which, in waters collected within the range of sewage contamination, or of surface drainage charged with decomposing matters, must be regarded with the greatest suspicion. A like observation applies to one particular class of the fixed salts, viz., those containing nitric or nitrous acid, which, when occurring in spring or well waters in Glasgow, can only be regarded as the ultimate form of oxidation or decomposition of the organic impurities.

In columns (4) and (5) accordingly, of Dr. ANDERSON's Report, the partially oxidised organic matters, and the ultimate products of their oxidation, are severally estimated. It would lead me too far into chemical details, to explain the relative importance of the details recorded in these two columns. Suffice it to say, that while the purest waters always contain an appreciable proportion of organic matter, the presence of even a minute proportion of nitric acid is to be regarded as an abnormal fact, and one which under certain circumstances may indicate danger. I am informed, indeed, that the smallest amount of nitrates recorded in column (5) corresponds to the oxidation of a much larger amount of organic

matter than the greatest amount in column (4); while, as stated by Dr. ANDERSON, the largest amount exceeds the smallest by no less than twenty-three times; leading to the inference, in this case (No. 9), of a quite enormous amount of decomposing matters present in the soil, and ready at certain seasons to yield to the water impurities of a more dangerous kind than nitrates. The conclusion is unavoidable, that even the smallest impregnation of nitrates in a drinking water is to be viewed with suspicion ; while a water containing nitrates, and at the same time within the range of possible contamination by the impurities derived from human habitations, or from collections of animal or vegetable refuse, must be at once condemned as a source of domestic supply. And it is to be observed that the tastelessness of the water, or even its specially agreeable taste, and apparently good qualities as a drinking water in ordinary seasons, has been proved by experience to be no security at all against disastrous consequences during epidemic seasons.

Judged by these tests, the greater number of the waters reported on by Dr. ANDERSON must be regarded as (to say the least) open to suspicion. But as some of them are much less than others within the range of probable dangerous contamination, and as many of them are chiefly used for bleaching purposes, I shall endeavour to base my recommendations on a reasonable attention to the convenience of the public.

Nos. 9 and 10 are situate in the very midst of large populations, and must therefore be condemned without reservation. In the case of the Bridgeton Well, indeed, it is perfectly obvious that the water is within the range of soakage of a great quantity of stable manure, as well as of a privy in the immediate neighbourhood. It is impossible to imagine a more dangerous water than this would be during an epidemic season ; and yet, although these facts are quite notorious, or at all events can be ascertained without much difficulty, they do not hinder the water of this well from being extremely popular, and I am told that an attempt to remove the well some years ago was strongly resisted. Probably the peculiar flavouring of the water comes, by long habit, to be rather relished than otherwise ; and I do not doubt that some of the drinkers consider this pump as superior to Loch-Katrinc. It will be for the Water Commissioners to consider whether, in removing this

source of supply, a public fountain of Loch-Katrine water should be introduced in its place.

The well in Old Coach Office Court is chiefly used for the supply of the stables, and it is said to be properly a private well, though occasionally used by the public. It would be difficult, perhaps, to contest the right of the proprietors to retain this supply for their stables, but it ought to be absolutely closed to the public, and carefully watched by the Police, especially in epidemic seasons.

The well in Kelvingrove Park (No. 12) may be closed without any practical inconvenience, and the same observation probably applies to Clelland's Well, in the Green (No. 6), which, from its impregnation with iron, is not much used by bleachers.

Arn's Well is in a different position. It is a favourite bleaching well, and, though containing nitrates in considerable amount, is too remote from houses to be used as a regular source of domestic supply. The same observations will apply to this well as to the other waters in the Green, with the understanding that, in point of chemical composition, Arn's Well is the most open to objection of all of them.

In regard to all of these waters, however (Nos. 1-8), I would make one remark. The danger to be apprehended from them during epidemic seasons will not, in all probability, arise from their strictly domestic use, so much as from the crowds who, in search of health or recreation, quench their thirst at these wells when heated by exercise, especially in summer. This danger might be practically obviated by giving a sufficiently ample supply of Loch-Katrine water, conveniently and, if possible, ornamentally disposed at different points on the Green, with a special view to the thirsty pedestrian, but not placed so as to be drawn for bleaching purposes. The bleaching wells, on the other hand, could be easily made inaccessible, or at least inconvenient for drinking, by fixing the taps as low as possible, and withdrawing the cups at present attached to some of them. They would thus be practically limited to the use for which they are at present so much esteemed, and for which they are on the whole so well adapted. Without some such improvement as this, I am afraid I should be obliged, in conformity with Dr. ANDERSON'S suggestions, to recommend the closure of Arn's Well, and perhaps of some of the others also, at least during epidemic seasons.

W. T. GAIRDNER.

